CHAPTER

# 2

# ANALYZING BUSINESS REQUIREMENTS

**After reading this chapter and completing the exercises, you will be able to:**

- Explain the importance of doing a business requirements analysis
- Explain the criteria against which a network infrastructure design is measured
- Describe the life cycle of the design process
- Define existing and planned business models
- Identify existing company processes
- Analyze organizational structures
- Analyze company strategies
- Analyze existing IT management structure

In this chapter you will learn why business requirements analysis is so critical to the success of a network infrastructure design. We'll start by discussing the importance of analyzing business requirements and we'll finish with a discussion about analyzing the existing IT management structure. Between these first and last points, you'll come to appreciate that business requirements analysis can't be shrugged off as a fluffy sideshow to the main event that is network design.

## Why You Need Business Requirements Analysis in Network Design

A network infrastructure design is successful only if it meets the business requirements of the organization. Thus, before we can design a network infrastructure, we need to understand the business requirements, or needs, of the organization. Unfortunately, the "real" needs of an organization are seldom clearly defined. To discover the needs, a network designer must have a firm grasp of organizational structure and communication flow and be able to communicate with the people who make up the organization.

I already can hear you gasping. Talking to people may not be why you entered the IT field. Technology is interesting, absorbing, complex, usually somewhat predictable, often challenging, and typically does not require a great deal of human interaction. Dealing with people, on the other hand, can be confusing, ambiguous, frustrating, and very time consuming. However, if you don't make an effort to talk to the people you are serving (and yes, you are in a service position), you will end up alienating them and creating a final result that does not meet their needs. When that happens, you have created a career-ending opportunity for yourself.

Finding out the business requirements, or needs, of the organization will not be easy. Make no mistake—people from different parts of the company will often confront the designer with conflicting needs and perceptions. For example, a database administrator is probably looking for easy administration, stable servers, and secure data. The sales manager, on the other hand, may want the sales team to be able to access up-to-date inventory information from a laptop from anywhere in the world. Your end solution might be providing a remote access scheme for the sales team that is still secure enough to satisfy the database administrator. The trade-offs that you will encounter on your way to a "good enough solution" will certainly keep you dancing. However, if you decide not to dance (that is, if you decide to skirt around the communication process, or worse, ignore the process altogether), you will likely encounter the following problems:

- The design may not meet the real needs of the organization.
- Time, effort, and money may have been expended uselessly.
- Delay in implementing a functional network can occur.
- Critical business needs may go unmet.
- The designer may be deemed to have failed.
- The designer may be considered incompetent.
- The designer may be looking for another job.

Well, enough of the doomsday predictions. Let's move on to a discussion of how your success will be measured.

# Measuring the Success of a Networking Services Infrastructure Design

What constitutes a good networking **services** infrastructure design? It is a design that meets both the present and future needs of the organization and allows for growth and changes within the organization, without extensive modification to the infrastructure, for a period of time defined by the business and technical analysis of the organization. Note that there can be different time criteria for portions of the infrastructure. The hardware infrastructure may have one desired life span, while at least portions of the TCP/IP infrastructure (services and protocols) may have a much different, usually shorter life span.

The label of "good" or "bad" is bestowed on a design based on its ability to meet stipulated levels of performance in a number of areas. Of the many considerations that can go into the design of a networking services infrastructure, all of which interact with each other, we have selected six elements for discussion to serve as the design basis against which the "quality" of a design can be measured, although these six are not explicitly tested for in Exam 70-221. You need to know them, however, because they represent a good, professional survey of what you will encounter in the field.

The following are the design objectives we will use to measure the success of our network designs:

- Functionality
- Availability
- Scalability
- Security
- Cost
- Performance

## Functionality

When determining **functionality**, the designer must create a design that will provide the required purpose or utility that drove the need for a new or improved network design. The design must work—it must be functional. Put simply, the designer needs to find out who has to connect to whom and for what purposes, and then make the design follow that path. In other words, to be functional the network design must provide needed results! You may chuckle at our overt definition and discussion of functionality because you think it is too obvious to be worth mentioning. We beg to differ. We have seen many examples of technologically "cool" designs that failed to deliver on the needed functionality. All the bells and whistles in the world can't make up for an unhappy vice president who looks at the final design and says, "Yeah, but what about my deliverables?"

## Availability

Closely related to functionality is **availability**. The resulting design, once implemented, must make the required services available 100% of the time that they are required. A facet of availability is reliability. The user must be able to depend on the network. If the programs, data, printers, servers, and other network resources are not always available when needed, then it is not a working solution. The network resource must be available to the users when they need it!

Although you may be comfortable with your conception of "available," be very aware that your definition might not be shared by those in the organization who are paying your bills. For instance, consider that you work for a retailer. An outage of one day might not bother a retail establishment in June, but that same outage on December 24 might cause you a problem. Those in your organization who pay the bills define "availability"—never forget that.

## Scalability

**Scalability** is the ability of a computer or network to respond to increased demands. Scaling up an individual server can mean upgrading the server hardware, which can include adding more memory, going from single to multiple processors, and upgrading the disk subsystem. You can scale up services and applications by providing software scalability (or what Microsoft calls "scaling out") with Microsoft Cluster Services. A cluster is a group of computers that runs a common application but appears as a single computer to the client and the application.

In a network design, scalability means that we have considered how each aspect of the design can be modified to accept increased usage. When considering bandwidth for our design, we want to have sufficient bandwidth not only for the day the design is implemented, but also for a predetermined period of time. What will it take to significantly increase the bandwidth? If we have selected ISDN for the WAN connection from a branch office, what happens if the bandwidth requirements at the branch office double in the six months following the implementation of the design? You better be prepared!

## Security

**Security** is another important design aspect. Each service has unique security and configuration options. These options must be chosen such that the required level of security is achieved. *If the network needs to be secure, it must actually be secure, but the definition of what secure means needs to be clearly spelled out and agreed upon!*

Don't be satisfied with just giving lip service to this concept. In today's environment, security is a fundamental consideration. How you define security determines the effort you must put into making the network secure. Does secure merely mean that the design prevents unauthorized users from gaining access to confidential data? Or does secure mean that the system must be fully protected from external hackers working to make the system fail?

Consider the human element as well. Although most people trust their co-workers, security experts consider insiders a significant threat. Does secure mean keeping employees from accessing another user's account or a system they are not allowed to access? In today's open internetworked and Internet-accessible environment, you need to reevaluate how much "trust" you want to extend. And with the trend toward organizations allowing access to all or parts of their networks to vendors, customers, and partners, the line between insiders and outsiders is starting to blur. Security is a critical issue.

## Cost

Cost must be included in your design because everyone operates under some budget restraints. Appropriate decisions cannot be made without understanding the costs associated with a proposed network design and relating those costs to the budget limitations. There are many elements involved in the cost of a network. The cost of the physical equipment and software required, the cost of the design effort, the cost of installing the communications system, the cost of personnel training, and the cost of system testing and implementation are just some of the initial costs. Then you must consider the ongoing costs of operating the system: the monthly fees for communications lines dedicated to the system, the personnel and operating overhead costs, etc.


You will, in real life, have to weigh cost against budget and you will have to defend the costs of your proposals.

## Performance

The concept of performance can be murky when you first approach it, especially when the definition of performance begins to blend into the definitions of the other criteria. In addition, when these concepts do start blending, it's hard to remember which one is the most important.

When someone approaches us and asks us to choose the most important design criterion, our response is always thus: We'll answer that question when we decide what is more important to life itself, food or water. In other words, the concepts cannot be separated!

To further our discussion, consider the following:

- A car is functional if it moves forward on the pavement. However, its speed (performance) is questionable if it travels only 5 mph.
- A car is available if it is sitting in the parking garage. However, the total hours that I can use it (performance) is questionable if I have to share the car with another driver.
- As car is scalable if I fold out extra seats for extra passengers. However, if the seats are on rusty hinges, opening and closing the seats (performance) can be difficult.

- A car is secure if I place locks on the door. However, its impenetrability (performance) is questionable if keys have been made for the entire neighborhood.
- A car meets my cost requirements if I can buy it without breaking my budget. However, if I don't have control over the variable costs associated with operating the car (performance), it might be too expensive to drive.

The rule of the criteria game is this: Know what your efforts will be measured against. If you know the target, you have a better chance of hitting it.

## The Life Cycle of Network Design

The design of a network follows a simple and predictable path. The stages are logical, with each succeeding stage depending on the preceding one. In a large organization there may be teams of people involved in the networking services infrastructure design process, while in a medium-sized organization this responsibility may fall to just a few individuals. No matter the number of individuals involved, they should follow the stages of design, performing a variety of tasks at each stage.

The stages of a network design include:

1. Data gathering
2. Data analysis
3. Design decisions
4. Network testing
5. Network implementation
6. Network management

What's linear in theory is often nonlinear in reality. That is, in real life, the design cycle is not simply linear. In real life, portions of the cycle, or even the whole cycle, will repeat as necessary. Any number of factors can cause the repetition. For example, repetition may be based on new events or new information you learn about the purpose of the network. In addition, a discovery that portions of your design are simply inappropriate or inadequate for the purpose may cause the need for modifications. Figure 2-1 illustrates the network infrastructure design cycle.

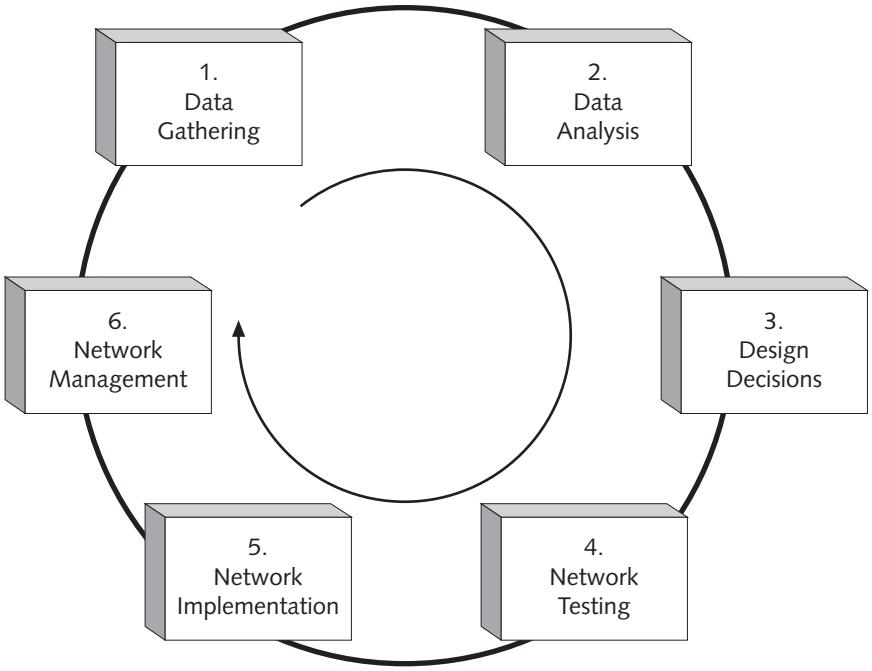


**Figure 2-1** The real-world design cycle


Studying the life cycle is not an academic exercise. Knowing its parts helps you make decisions at the beginning of the design process and defend those decisions at the end of the design process. As we all know, defending your work is half the battle in IT!

## Data Gathering

The first stage is the data gathering stage. You must decide who has the information that you need. For information about the immediate problem, you need to work with those people most directly involved. However, because a network typically impacts so many people and the design should work for a substantial period of time without redesign, remember that they represent only one part of the information needed.

You need to consult with many sources. To find out about the existing organizational processes and structures, company strategies, and the IT management structure, you might interview nontechnical upper management, technical upper management, middle managers, support staff for the current systems, and even other technically qualified network designers.

You might need to go to sources beyond the organization, as in the case of organizations in regulated professions, when the design must take into consideration relevant laws and regulations. These laws and regulations may set limits and requirements on the functional, security, and availability aspects of the design. Likewise, if there are any special vendor, partner, or customer relationships that must be supported by the network, the designers must determine functionality, scalability, availability, performance, and security needed for each of these unique relationships.


Each data source has its own bias. People see things from their own perspective. You may well get your questions answered, but the answers will probably be biased to reflect the needs, goals, desires, and concerns of the group the data source belongs to. This is why it is important to understand the overall structure of an organization so you can deal with the built-in biases of each piece of the organization.

Second, you must decide how to get the information from the sources that you have identified. Data can be gathered in many ways. Interviews, meetings, published reports, questionnaires, and perhaps even break-room discussions are all tools that can be used. A good network design depends on an accurate and thorough gathering of information.

You then will compile a list of questions (we'll discuss the specifics of this later). Once the list of appropriate questions is assembled, you may well ask some of the same questions of everybody, but you can expect certain people to be better sources of certain information. For instance, information gathered from key people, such as the CEO and other upper management, will be most reliable for understanding the overall business model, geographical scope, decision making, company priorities, and the company's tolerance for risk. These people will also provide the best information on projected growth. Generally speaking, middle management will be your best source of information on company processes.

There are extra considerations that you must take into account when gathering data. We'll discuss them next.

## Gaining Trust and Setting Ground Rules

A good network architect integrates business needs with technical requirements. To do this you must find the *real* business requirements. This can be difficult. To overcome this difficulty, one consultant we know uses a tool to gain the trust of the customer and to persuade them to open up and speak freely. He tells them how important the information he needs is to the success of their network, and he offers to sign a very restrictive nondisclosure agreement (NDA) before he asks them to divulge business information to him. He actually had his lawyer draw up an agreement so stringent that the client almost always signs without modification. As he puts it, "They can do me great bodily harm if I disclose the information they give me to anyone." He also lets them know up front that if they are not candid and forthcoming with him, they are just wasting their time and money.

His approach works because he is not an employee and the offer to sign the NDA convinces them that he is serious about needing accurate, confidential information. If you are an employee, you probably don't need to emphasize that you won't disclose company information, but you do need to find some way to convince management that they really must open up to you about future plans. They may be reluctant to disclose their future plans because they feel you don't have a "need to know," or they may just be embarrassed that you are asking questions they actually haven't got answers to. Either way, you still need to get the information. So your task is to show them how important it is to the future of the company that misinformation or lack of information not compromise the network design.

Once you have management's promise of cooperation, don't abuse them! Be efficient and ask the minimum number of questions. Of course, this means you have clearly thought through the questions you want to ask. Ideally, gathering information from management for both the business and technical analysis should not take a great deal of their time. In a medium-sized or large organization, make sure you have several people to carry out this information-gathering process.

## That Which Is Gathered Must Be Organized

As you gather information for the business analysis, you will need an effective way to organize and analyze this information. There are many methods a designer may use. One metaphor for describing trade-offs between the basic elements that go into designing any product is the Good-Fast-Cheap triangle. Imagine an equilateral triangle with sides labeled Good, Fast, and Cheap. Then imagine you are looking at this triangle from the side so you can only see two sides at any one time. Thus the trade-offs you must make about quality, speed, and cost become clearer. The product can be high quality (good), and you can get it quickly (fast), but because of the resources you have to pour into making it both good and fast, it probably won't be cheap. Similarly, you could choose to have it be both inexpensive to make (cheap) and high quality (good), but it will take a long time to achieve both those goals so you won't get it quickly (fast). Finally, you can choose to get it quickly (fast) and inexpensively (cheap), but it likely won't be of high quality (good). See Figure 2-2 for an illustration of these concepts.

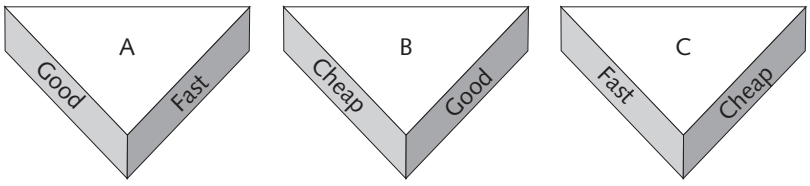


**Figure 2-2** The Good-Fast-Cheap triangle

A similar metaphor is used by Ken Barnhart, an IT consultant in Minnesota. Ken uses a model he calls the **Iron Triangle**. For any given triangle, no one side can vary without adjustments in the length of the other sides and/or the angles between them. The three

legs of his triangle are load, resources, and performance (see Figure 2-3). In Ken's model any two legs define the requirements of the third leg. For example, if the load is large but the resources are limited, the performance will tend to be low. If higher performance is required, then either the load must be reduced or resources must be increased, or both. TANSTAAFL (There ain't no such thing as a free lunch) definitely applies in this situation.

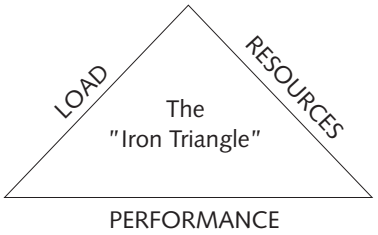


**Figure 2-3** The Iron Triangle

The information that is gathered for each side of the triangle can be placed into buckets, figuratively speaking. We'll discuss those "buckets" next.

## The Load Bucket

The load bucket is where you place information about the applications that your clients tell you they need in their business. This information is gathered during the business analysis, and these applications make up the organization's **application portfolio**. The information you gather includes not only the description of the application but also its technical requirements. Security requirements also belong in the load bucket, because the more stringent the security requirements, the greater the processing and network load. You should consider the portfolio and security requirements as essentially non-negotiable because they represent the real needs of the company.

Other information that goes into the Load bucket is distribution of users and resources. You will acquire some of these data while gathering information for business analysis, when you learn about branch offices, regional offices, planned organizational structures, outside relationships with partners and vendors, and growth projections and plans. The more time you spend on business requirements, the better picture you'll have of the real load of the business application portfolio and security requirements. You will clarify this picture further during the technical analysis.

## The Resources Bucket

Most of the information for the resources bucket will be gathered during the technical analysis, which we discuss in Chapter 3 of this book. The Resources bucket is where you place information about the underlying network infrastructure: topology, type of media, bandwidths available, and bandwidths required. Placement of servers, data and system access patterns, and **server roles** (file and print, applications, WINS, DNS, Web, etc.) are other items for the resources bucket. Resources have costs associated with them; therefore, they can be limited by the budget for the project.

### The Performance Bucket

The final leg is performance, which, because of the nature of the Iron Triangle, is directly affected by the other legs. The applications portfolio and the distribution of users will place a certain, measurable load on the infrastructure. If the Load leg is lengthened by additional applications but the existing resources are not adequate to handle the increased load, the performance leg will be shortened. If business needs dictate a specific level of performance and the load leg cannot be shortened, additional appropriate resources must be added (the resources leg lengthened) to accommodate the performance requirement.

Although performance tends to be somewhat subjective, there must be some objective definition for there to be any usable measurement of it. Some customers will provide only vague definitions of their performance needs, such as "orders must be processed within 30 seconds." Others may provide you with highly detailed mathematical analyses of the performance required. Regardless of where on the spectrum the information exists, it goes into your performance bucket.


The failure to provide adequate network and server capacity is often blamed on the IS organization, when in reality it may be a failure of the business units to provide the IS organization with a clear picture of needs and growth. Nonetheless, it's still up to you to make sure you get that clear picture.


In industry, IS and IT are often used interchangeably.

## Data Analysis

Data analysis is the process of taking information and attempting to understand what that information means in terms of the situation you are trying to resolve. It might be as straightforward as examining the data transmission rates of your existing network infrastructure and comparing those rates against the data load your analysis shows you will have to calculate to determine whether the existing infrastructure will carry the load.

Data analysis also can be as subtle as interpreting the remarks of senior executives about expected company growth and finding that their opinions differ widely. In this case, you still need to try to get a consensus because you do have to allow for expected future growth. You may be reduced to using an educated guess. This sounds like an oxymoron, but it really isn't. Sometimes you really are reduced to making a guess, but the "educated" part means that you take all the information you have been given and somehow synthesize it into an estimate (guess) of what you probably need. Experience has shown that educated guesses are often nearly as accurate as detailed, exhaustive analysis. The more experience you get, the more accurate your guesses will become. Even highly experienced network infrastructure designers have told us that they really can't explain in detail the mental processes they go through to arrive at an estimate, but their guesses are often pretty darn good!

You analyze your data to determine the required functionality, availability, scalability, security, cost, and performance. In other words, you are determining the expectations for each criterion. (You knew those criteria would come back into the picture!)

You must determine all expectations in advance. It is particularly important that agreement as to the details of each of these be reached between you (the designer) and those decision makers for whom you are designing the network infrastructure. Without such agreement on the requirements of each of these things, there can be no objective way to measure the success or failure of the design.

Once you make your analysis, you can start making decisions.

## Design Decisions

Only after the analysis takes place and agreement is reached on the measurement criteria does the design team choose the individual services and decide upon the appropriate settings for those services. This is done to satisfy the functionality, availability, scalability, security, cost, and performance requirements.


In case you're not familiar with the term, in computing, a **service** is a software component that provides a specific capability. Accessing this capability often depends on a client component. For instance, the DHCP service provides automatic IP configuration to a computer configured to be a DHCP client. Microsoft Internet Information Services (IIS) allows administrators to publish web pages that are accessible when users connect to the IIS server with an Internet browser, such as Internet Explorer.

In this book, you will select network services from the list of services built around the Windows 2000 implementation of TCP/IP. The list of basic services was introduced in Chapter 1. More specialized services will be introduced in later chapters.

## Network Testing

Designers cannot simply decide on a theoretical design and leave the process at that point; the design must also be tested. Some hardware and software components you select for your design might be certified by the vendor (or an independent lab) to be compatible with Windows 2000 or your applications. Even so, you really will want to do your own testing, because only then will you know that the specific combination of hardware, applications, and services you will bring together on your network actually work.

The team that will actually test the design will combine the chosen services on servers as needed. The results of the testing might be used as a proof-of-concept for the authorization of further testing. The proof-of-concept does not demonstrate the solution of all the problems or objectives; it simply demonstrates the viability of moving forward.


Read more about this proof-of-concept, which was described as the Data Center of the Next Millenium, at http://www.win2000mag.com/Articles/Index.cfm?ArticleID=8124.

There was a famous (a least for a week or two) proof-of-concept at the Comdex/Fall 1999 to demonstrate Windows 2000's scalability. Unisys and a consortium of industry partners created a massive Web site for a hypothetical e-commerce company, Interstellar Outfitters, a supply station for spaceships and stations. Using modeling techniques, they simulated the load of 4,000 transactions per second (tps), or just under 5 billion Web hits and 300 million page requests per day. This proof-of-concept project had an estimated cost of about $12 million in hardware and software.

Any problems discovered during the test of the design must be corrected and more testing must be performed until no more problems surface. Only after you have tested your design theory in a prototype lab and demonstrated that the design is viable do you proceed to the implementation stage. There are tools, discussed in Chapter 3, which can help you to model the real network loads and usage and test the effects on your design.

We suggest you still don't go straight to full implementation! You really ought to do a pilot program, using real data, in parallel with your existing network, to make sure the entire system—hardware, software, communication lines, and personnel—are functioning correctly.

Of course, there are those of you who might choose not to test your network. After all, it might seem like a convenient shortcut to not bother. As a personal favor to us, would you resist the urge? We know of a law firm that failed to adequately test a new networked backup strategy. Under the advice of a consulting firm, they were diligent in designing their backup strategy, including a cost/benefit analysis of implementation of the various backup and restore components. The backup strategy was finalized, put into place, and carefully followed. The problem with their backup strategy was that they didn't actually perform test restores. They relied on the verification component of their backup process as assurance that they actually had archived data. Disaster struck when they experienced a major data loss as a result of a severe hardware failure. When attempting to perform restores of their "archived data," there was none. None! The tapes were blank. The long and the short of it is that they went out of business as a result of this "simple" oversight.

## Network Implementation

Once initial testing is completed and the design has been shown to function according to the critical elements of a good design, the implementation stage must be accomplished. This will include not just the installation and configuration of services per the design, but also the installation of management procedures to collect information on the performance of the system and the effectiveness of the design.

Implementation is fraught with both mechanical and personnel perils. Mechanical perils can include delays in delivery of equipment, delays in installation of communication lines, unexpected problems when pulling cables, conduits that are not large enough for additional cables, and many other totally unforeseen events. Any of these events can derail your efforts by causing increased costs, delayed implementation, loss of credibility with management, and even actual damage to the business profits.

Personnel perils can include nonunion people trying to pull cables (thus possibly violating union contracts and causing protests to be filed), physical injuries to personnel who are moving heavy equipment and furniture or crawling through tunnels or climbing ladders, and untrained or improperly trained people damaging the network. Personnel problems can derail your efforts by the implementation taking longer than necessary, by people becoming so frustrated they quit, and/or by operational errors that cause real damage to the company bottom line.

### Network Management

Normal operation of the new network services begins after the implementation stage concludes. Ongoing management of the network services, of course, follows this. While managing the system, you will continue to gather more data about how the system functions, analysis of which will determine whether the design continues to meet the needs of the organization. From time to time, the design process will undoubtedly have to be revisited and tweaked to meet the ever-changing needs and growth of the organization.

Network management tools vary based on the hardware and software included in your network. They also vary based on your definition of network management. Network management may mean the configuration and monitoring of network devices such as routers and switches, in which case you might select network management tools from the vendor from whom you purchased the equipment. Network management may also mean the management of desktop computers and can include both of these functions.


A discussion of project management is beyond the scope of this course, but effective project management is very important to the successful design and implementation of the network infrastructure design.

## Analysis of Business Models

All right, enough with the theoretical. Let's move on to the practical. The "practical" that you need to master is how to approach a business and categorize it so that you can quickly obtain the information that you need to make correct design decisions. Fortunately, models exist to help you clarify your thoughts.

### Geographic Company Model

The geographic company model is especially interesting to the network designer because this is your first indicator of how complex the network communication needs will be. The geographic company models that Microsoft defines for Exam 70-221 are branch, regional, national, international, and subsidiary.

#### Branch Office

The branch office, or district office, is a small presence for an organization, usually representing a single function. Sales or service functions are often placed in branch offices to be near the customer. A branch office is usually minimally staffed with just the number of

people needed to perform the customer-related function of the office. Branch offices will usually need reliable connection to the corporate intranet, but may not have many users or require a great deal of bandwidth.

In analyzing a branch office's needs, it is important to determine the number of users and their connection requirements. Figure 2-4 illustrates a basic branch office model. If you can categorize your organization as fitting this model, you already know something about the connection needs of the organization.

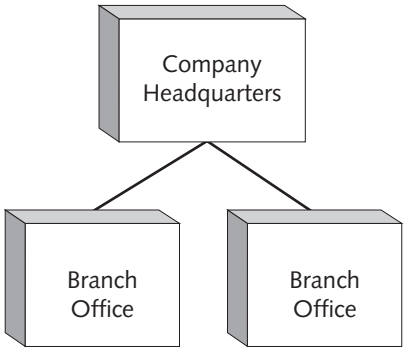


**Figure 2-4** Branch office model

## Regional Model

An organization that fits the regional model has physical locations in one or more geographically defined regions. Regions usually include a portion of a country or portions of several countries.

The boundaries of a region usually involve hundreds of miles. Within each region there is normally a larger, central presence, or regional office, with all necessary support personnel for the functions provided from that region. Regional offices may also provide support services to branch offices. You can expect a regional office to need a full-time, high-speed connection to the corporate intranet. Regional offices also need connections to branch offices subsidiary to them. See Figure 2-5, which includes a regional model as a portion of the national model.

As with the branch model, if you can categorize the company as fitting this model, you already know that employees at the regional offices must communicate both with the main office and branch offices, if they exist. You will need to ask questions to flesh out how they communicate and what can be improved about these communications.

## National Model

An organization that fits the national model has a physical presence in regions covering an entire country. A national geographic model includes several regions. In addition, there is usually one corporate site that functions as the center of the entire organization. Each

regional office will need a full-time, high-speed connection to the corporate intranet as well as connections to subsidiary branch offices. Figure 2-5 depicts a national model.

If you can categorize the company as fitting this model, you already know that you must examine how communication is occurring between the various locations. Later in the technical analysis, we will look more closely at the technical requirements of these communications, but for now it is important to understand what business problems need to be solved by communications between the sites.

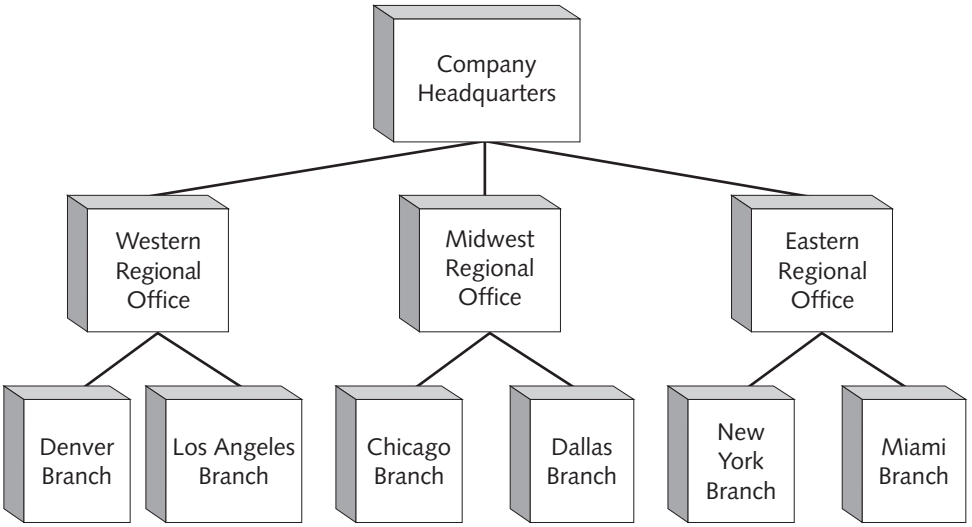


**Figure 2-5** National model

## International Model

The international model expands the national model to multiple countries. While you still have the one central corporate presence as the worldwide headquarters, each country usually requires a significant presence. Also, within each country, an international company may well have regional and branch offices. Additional concerns with an international model include compatibility of the communications systems and reliability of the links.

Once again, if you can categorize the company in this model, you already know that your network design must take into consideration how users will communicate between the various sites. The international model adds the complexity of dealing with a variety of connection services across international boundaries, but this is more of a technical problem.

## Subsidiary Model

A subsidiary organization can, theoretically, stand alone as an autonomous organization. In general, subsidiaries of a corporation have their own communication, data processing, network infrastructure, and support services.

There will probably need to be a high-speed link between the parent company and the subsidiary, mainly for financial reporting and parent company oversight. The two organizations often do not integrate their functions. Subsidiaries will themselves tend to have their own branch, regional, national, and international organizations.

If the company has or plans to have subsidiaries, the designs must involve communication between LANs that serve the separate subsidiaries. Then, along with functionality and availability, extra consideration for security services may be necessary. Figure 2-6 shows the relationship between a company and a subsidiary.

If you can categorize the company in this model, you already know that you will have the same set of concerns about communications across different sites. But you will also need to determine what corporate services, such as accounting, are shared between the parent company and the subsidiaries, and what functions are duplicated in each entity. At least parts of the IT management functions may be less centralized in a subsidiary model.

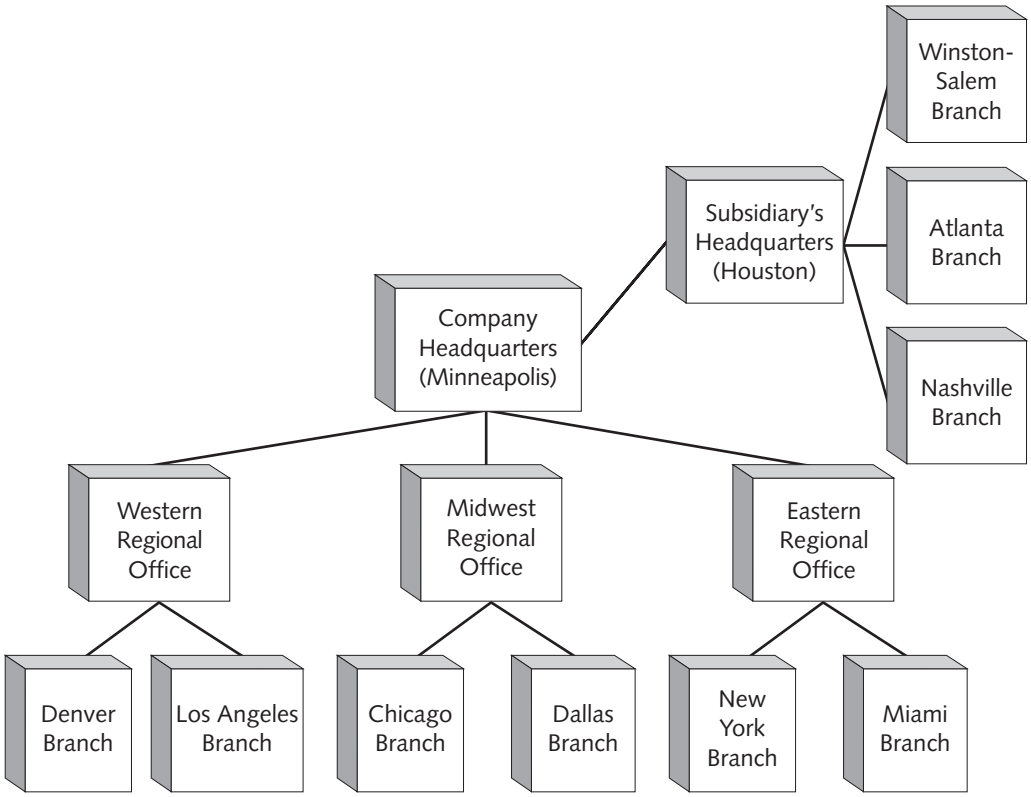


**Figure 2-6** Subsidiary model

### How to Detect a Company Model

Here are some suggested questions you can ask to determine the existing and planned business models:

- Does the company have or plan to have branch offices?
- Is this a regional company?
- If so, how many regions are there?
- Do branch offices receive support services from regional offices or from the corporate site?
- Does this company have or plan to have a national or international presence requiring geographically separated physical locations?
- Does the company have or plan to have subsidiaries?

## Identify Existing Company Processes

So, you know the criteria for the design and you have a good idea of how the company is organized. Now, it's time to identify the processes of a company. You'll discover the processes by asking questions. You need to ask many questions of many people to adequately understand the company processes. Don't just ask questions of "key" people. Some of your best information will come from those who are involved in the day-to-day work at a hands-on level. The answers to your questions may lead to other questions you want answered, so you'll need to create more questions as you go.

As you become more of an expert in formulating and asking questions, you will be able to recognize situations and processes without having to ask all the questions. Then you only need to ask questions to confirm your analyses. Note that even if you think you know the answer, you still need to ask the question! You never know when your assumption is wrong.

Microsoft exam objectives include the following processes: information flow, communication flow, service and product life cycles, and decision making. It's now time to discuss each in turn.

### Information Flow

As a network designer, you must understand the flow of information through the organization. Information flow can be defined as the necessary distribution of information to accomplish the work of the business. You must ask several questions to help in the selection of services, the appropriate configuration of those services, the placement of servers, and perhaps the addition of new clients and connections.

Let's illustrate this with an example. Suppose a specialty catalog company is moving from separate systems for order taking, inventory management, billing, and fulfillment to a system that integrates all these functions.

In the old system, this would be the process:

- A purchaser would call the company. They would place an order for the products that they wanted, either by name or by catalog product number, and the person on the order desk would enter information into their system. The name of the purchaser, their address, and their payment information would be entered into a database.
- The clerk would check an inventory database residing on a server to make sure the products were available. After ending the call, the clerk would send the order to the warehouse to have the products picked from the shelves and transported to shipping. The order to the warehouse might have been printed on a printer at the warehouse, or it might have been hand-carried.
- The shipping clerk would match up the products delivered to shipping with the shipping paperwork received from the sales clerk. There were many gaps in this system, involving manual entry of billing and ordering information. Some necessary communication was accomplished through phone calls and faxing.

You would consider the information flow under the old system as you modify the physical and services infrastructure to make a new, comparable, automated information flow. Here are some questions to ask when gathering data about information flow:

- What information is sent from one place to another?
- Where does it come from and where does it go?
- How much information is sent?
- When is it sent?
- How does information flow through the company?
- Does the current network support this information flow?
- Is there important information flow that is not being served by the present network?

## Communication Flow

Communication flow is the physical pathway(s) by which information flows. Network designers will discover that critical information follows many formal and informal pathways. Interpersonal conversations may travel by e-mail, phone, "snail mail," or pager, to name a few pathways. Some of these pathways include the corporate network infrastructure and may be improved as a result of a new design.

To document communication flow, you need to examine the existing network infrastructure to find where data are stored and where they are sent. Data are stored on servers located on the network. Both internal and external users can access it. More detail on tracking communication flow will be found in Chapter 3, where we analyze technical requirements.

Here are some questions to ask when determining the communication flow:

- What are the pathways across which the information is sent?
- Which information flows as a data stream on the network (file transfer, e-mail, intranet)?
- Which communications presently are "off the net," such as regular mail or telephone?

## Service and Product Life Cycles

Most service functions are busier at some times than they are at other times. With service and product life cycles, there are often predictable milestones when the network will carry the heaviest load. For example, retail businesses that see their heaviest activity before the holidays may require network changes and cause variations in network usage.

Products also have life cycles. They go from conception through design, prototyping, pre-production, production, and phase-out. Product and service life cycles can be tied to availability of supplies. Businesses involved in food processing experience production cycles when crops are available for processing. Although this may not be directly reflected in sales cycles, because processed foods are warehoused and made available to the consumer all year long, they will create increased activity within the company.

The need for network services will ebb and flow with these cycles. Understand them and find ways to predict when the greatest network demands will occur. You will need to ensure that your network design can handle the maximum load with a comfortable percentage of over-design built in. This over-design can be based on your knowledge of the company's tolerance of risk and the budget available. Over-engineer as much as the budget will permit.


Understanding basic cycles will also allow you to take advantage of these cycles in reverse. For example, if you need to test a network, you may be able to find a time of low load or demand that will enable you to test portions of your network with minimal impact on the organization's production use.

Here are some questions to ask to determine service and/or product cycles:

- Is there a certain time of year when the product or service can be expected to have a majority of its activity?
- Is production cyclic also?
- Is the product only ready to be processed/manufactured at certain intervals?

- How well does the present network structure support service and/or product life cycles?
- What functionality is needed that is not presently supported?
- What are these cycles, how long do they last, and when do they occur?
- Are there certain time periods when production goes down and other time periods when production goes up?
- Is the product affected by holidays?

## Decision Making

All companies must make decisions. How decisions are made and who makes them varies widely, but there are certain typical models to help you understand this. One of the most common decision-making models is the authoritative, top-down model. In this model, upper management makes most decisions. Decisions may be made quickly and changes can occur rapidly or there may be a complicated process that must be gone through for even minor decisions to be made.

Another, less frequently seen model is when top management empowers people to effect change at the lowest possible level. This is sometimes called **delegation of authority** and within certain guidelines decisions can be taken quickly. Whatever model the organizations uses, decision makers need access to the company data and analysis tools, and they typically depend on communications from their subordinates and among themselves.

Here are some questions you can ask as you attempt to discover the decision-making processes:

- Are decisions about operations made centrally or within the divisions?
- Ask each manager what his or her level of discretion is. This may involve a dollar amount, or may involve the type of decision.
- Ask the managers what types of decisions they can make on their own.
- Ask each manager what types of decisions must be made by committee or with approval from a superior.
- Find out at what dollar level and at what job level decisions are made.
- Does the present network accommodate the present decision-making model?
- What functionality is needed that is not presently supported to aid the present or planned decision-making processes?

In this section you examined the importance of understanding company processes to a network design. These processes include information flow, communication flow, product and service life cycles, and decision making. When you take these processes under consideration, you will acquire a healthy appreciation of the complexity of network design.

# Organizational Structures Influence Network Design

The organization of a company is yet another way a designer decides where to place network resources. There are many aspects to an organizational structure. Some of these are obvious and some are much less so.

For instance, organizations can be structured in many different ways. Sometimes organizations are structured around function, such as manufacturing, sales, support, finance, human resources, administration, and so on. Other times, the company is organized with product groups that are structured around market segments. Any of these situations can be compounded by administrative functions that exist in multiple locations.

Each wrinkle of complexity affects the network design. In the following sections, we discuss approaches that help you discover the wrinkles before you start pulling cable.

## Examining Management Models

Understanding the style of management of the company is important. Knowing how and where decisions are made enables a network designer to provide the communications and services to support the decision processes.

For instance, an authoritative management style controls from the top down. This management model requires that resources are located centrally, and there would probably be centralized administrative control of the network. At the opposite end of the spectrum is the participative management model with decisions being made at the lowest level possible.

Here are some questions to ask to determine the current and planned management model:

- Is the organization controlled centrally from the top down?
- Are many procedures in place that must be adhered to or does the company encourage initiative and enterprise?
- Is the organization stable and profitable or is it constantly changing and adjusting to try to find a successful path?
- Have there recently been any changes in the ranks of upper management?
- Are there any rumors of potential changes?
- Is it a publicly held company with a board of directors, shareholders, and officers or is it privately owned?

## Examining the Company Organization

You will need to look at how the company is physically organized, because the physical network infrastructure must follow the physical organization. So the key question is, "How do the functions of the company map to the geography of the company?"

There are several common practices in organizing a company. One company may have each department, such as accounting, carefully kept in its own physical location but servicing all the business units of the company. Another company may not centralize a function such as accounting, but have an accounting function in each business unit. Whatever the case, the network infrastructure must accommodate whatever organization the company chooses. It is the company organization that drives decisions about the network infrastructure—not the other way around.

Here are some questions you might find useful:

- What is the geographic layout of the company?
- What groups service other groups in the company?
- Where do the service groups physically reside?
- Are they centrally located or distributed throughout the company, or both?
- How do accounting, purchasing, accounts receivable, accounts payable, payroll, human resources, and other administrative groups interact with other organizations in the company?
- How do customer orders get processed through the company?

## Examine Customer, Vendor, and Partner Relationships

An area that impacts the network infrastructure is the existence of relationships with customers, vendors, and/or partners. Suppose your company is a supplier of computer parts to a number of independent computer system builders. The current price of computer components varies day to day (sometimes even hour to hour) and your customers need to know pricing and availability in order to provide quotations to their customers. Your company thus maintains a current inventory and pricing database to which your customers can connect. These connections need to be included in any infrastructure design you make.

Similarly, companies often partner with other complementary organizations and there is a need for each organization to tap into the other organization's network. There may be significant political, business, and technical issues to resolve before the networks can work effectively together, but the management of the partners who are negotiating such partnerships expects that such network connections will work. Thus network infrastructure design should consider the present or future existence of partner relationships. These relationships, when implemented through the Internet, are now referred to as business-to-business or B2B.

Here are some useful questions that you can ask regarding company relationships:

- Is there any existing or planned close vendor relationship?
- What is the level of trust between the partner/vendor organizations?
- Does your organization depend on certain vendors and need network connections between your organization and the vendor?
- If not, would the organization benefit from being connected to vendors?
- What future plans are there for vendor relations?
- How do customers communicate with the company?
- How are the customers supported after the fact?
- Does the organization have relationships with special vendors?
- What network resources must be shared with these partners or vendors?

## Examine Acquisitions on the Horizon

Growth through acquisition is something that upper management needs to keep confidential until the long-negotiated acquisition is completed. However, when you are planning a network, you need this information. If you make decisions without it, the company may find itself with an organization that does not have sufficient network resources because the pending acquisition was not known at the time the network was planned.

It is critical that the network infrastructure designers know about acquisitions early. Much of the value of the acquisition depends on maintaining continuity, so the databases and the supporting network infrastructure are very important to the acquiring organization. It is imperative that what their network was supporting be preserved even though the acquired company's network usually merges with or is replaced by the networking infrastructure of the parent company.

Once you discover (or suspect) that an acquisition is on the horizon, here are some questions you might ask:

- What changes must be made to the design to include the new facilities, users, customers, and vendors that may result?
- Which of the acquired company's systems and services will be kept?
- Which will be abandoned?
- What systems do they have in place?
- What systems are redundant with the parent company's systems?
- Are the systems compatible?
- What systems can be retained if they are upgraded?

It is by now very clear to you (we hope) how important the organization's functions are to your choice of network design. How management functions, how the company is organized, the relationships with customers, vendors, and partners, and the existence of pending and possible acquisitions are all critical elements that you must include in your planning.

## Company Strategies

A network infrastructure exists to support the needs and objectives of the business. Thus, the network infrastructure is dependent on these business strategies. To understand these business strategies, and to understand what factors influence these business strategies, we will examine five factors:

- Company priorities
- Projected growth and growth strategy
- Relevant laws and regulations
- The company's tolerance for risk
- The total cost of ownership

When you can identify these five factors, you can design the network to accommodate the reality. At this point, let's discuss each in turn.

### Company Priorities

In your interviews with top management, you need to ask about the company's goals and the priorities, or relative priorities, assigned to them. Document the goals and assign a priority number to them. These numbers do not need to be absolutely accurate—you are only trying to get a good feel for which goals are most urgent and which are of lesser priority. The goals that are most urgent must get built into the design first and the others get built in only after the most urgent needs have been satisfied.

Here are some questions to ask concerning goals and priorities of the organization:

- What are the corporate goals of the organization?
- How will achieving these goals help the organization to achieve a competitive advantage?
- How do these goals align with the stated goals of the network project?
- Can we prioritize the corporate goals?
- Can we prioritize the network project goals?
- What corporate standards must we follow to achieve these goals?
- Which low-priority network project goals can be eliminated or delayed?

## Projected Growth and Growth Strategy

If the organization is forecasting growth, you will first want to find out the company's track record in predicting growth. If they tend to meet growth projections, and the same individuals are involved in the present calculations, then you will want to consider the growth predictions and strategy in your planning. If they have a poor or nonexistent history of predicting growth, proceed cautiously.

Here are some questions to ask concerning growth projections and strategies:

- What is the track record for the company's growth projections for the past several years?
- What are projected sales, in quarterly increments, for the next five years?
- What changes will have to take place to support these increases in sales?
- Will there be new locations to support growth?
- Will growth involve facilities in other countries?
- Will new functions be added to support growth?
- How many people need to be added to support growth?
- Where will they be located?

## Relevant Laws and Regulations

Do not overlook laws and regulations. If your industry is heavily regulated, you may be familiar with the need to comply with laws and regulations. Almost any company may have relevant laws and regulations that govern how the organization functions. For example, a network design for a hospital offers a special challenge because the data must be available but the confidentiality of the data must be ensured in order to comply with federal, state, and local privacy laws. Further, if the company is being monitored by some governmental organization, as in the case of pharmaceutical manufacturers, the design may need to include connectivity for reporting to a regulatory agency such as the Food and Drug Administration.


Local laws may even apply to such mundane things as wiring specifications!

Of course, a company that goes international has international-sized concerns. Simply put, an international company needs to comply with the laws of many countries. Consider a business such as an Internet auction house. You might assume that Internet sales are tax and tariff free. But when you are doing business across international boundaries, national and local laws may impact your business. You might inadvertently be violating another country's law that you are not aware of.


Work with the organization's lawyers to find out what, if any, laws and regulations may affect your network design.



## Risk Tolerance

What is the company's tolerance for risk? Knowing this may aid the designer in deciding if the design should include innovative or new but somewhat unproven technologies to replace older but proven reliable technologies. Or this may help the designer to determine if it would be acceptable to bring certain services "inside" that have previously been reliably outsourced.

If the company is highly risk aversive, it would be worth your while to consider creating a risk management plan. Although not easy to create, a risk management plan can help you avoid rejection of the network infrastructure by top managers. To create a risk management plan you need to identify the risk factors that might occur. Then, for each factor: estimate the probability that the event will actually occur; define the impact on the project if the event does occur; identify the department or personnel responsible for this risk area; and define what might be done to reduce this risk factor.

Of course, having a risk management plan does not change the fact that certain risks exist. It only makes you think about those risks and plan for their solution. Better to accept a risk for which you have a plan than to be surprised later! Remember to keep any plan up to date so that risk-averse management can feel comfortable that the network infrastructure design will succeed.

## The Total Cost of Ownership

One of the most frequently heard catch phrases today is **total cost of ownership (TCO)**. IT managers fret about it, track it, massage it, and demand that it be reduced. So what is it? The TCO includes all related costs of owning a computer, including the following factors:

- Cost of computer hardware
- Cost of computer software
- Maintenance costs
- Technical support costs
- End-user training

Make no mistake—whether articulated to you or not, you will be held to a TCO for your network design. TCO is usually estimated to be around three to four times the cost of the hardware and software. Networked computers can be administered centrally, which reduces the TCO.

Prior to Windows 2000, Microsoft's most ambitious contribution to reducing the TCO was their Systems Management Server (SMS) Back Office product. Within this product, Microsoft provided several centrally administered components, including hardware and software inventory, software distribution, remote control of client desktops, and software license metering. With the advent of Windows 2000, there are several technologies that are aimed at controlling the TCO for organizations. They come under the heading of change and configuration management.


To read more about TCO, go to the site of the industry experts: the Distributed Management Task Force Inc., at http://www.dmtf.org.

## Existing IT Management Structure

One of the more important areas for you to understand is the management structure of the existing IT organization. This organization is already in place and functioning, and its structure will have a major impact on how you proceed to design the network infrastructure you are working on.

IT management will be part of the design team and will also be responsible for the implementation and maintenance of the design. Areas of responsibility already exist, and people have been assigned to be responsible for those areas. You will need to work with those individuals to ensure that each area's needs have been included in your design. This will ensure that your network infrastructure delivers all that is needed to each group.

A very small organization of fewer than 200 computer users may not have any formal internal IT structure. However, the Microsoft 70-221 exam targets organizations with from 200 to 26,000+ computer users. These organizations will have formal IT structures, even if provided by an outside source or single individual.

To understand the IT organization, the following areas should be analyzed:

- Type of administration
- Funding models
- Outsourcing
- Decision-making process
- Change-management process

The following sections will discuss these considerations.

## Type of Administration

How the company has chosen to arrange the IT organization is critical to your design. If network resources are centrally located, they are probably also centrally controlled, and so you will have a relatively small management group to work with. If the company has chosen to distribute IT management resources geographically in a decentralized manner, there will also be decentralized control of those resources and the management group may be larger. There may also be a mixed approach in which some resources are managed centrally but others are decentralized.

Make sure you learn of any impending changes to the existing IT administration so you can include those changes in your infrastructure design. If you skip this, you may be surprised later. Such surprises almost always cost time and money if you have to change your design later.

## Funding Models

Capital expenditures, such as a network redesign, must be funded. The problem with funding IT projects is that IT is usually considered a part of the support structure. It does not stand alone as a business unit that earns a measurable amount of income. Instead, it is a cost item in other departments' budgets.

There are many models for valuing IT structure and services, and many practices for funding IT projects. Determining this is critical because it will tell you how many people need to approve your design. How the company funds IT will be a major influence on what you can accomplish with your design.

One widely used funding practice, charge-backs, bills each department for the IT services provided. Another practice is to allocate the cost of services across the organization using a formula. The formula may be tied to some measurable use of resources, or to some other allocation method. Although money does not actually change hands, the managers are well aware of the cost charged to them. If this is the case, then responsibility for approving your project is spread among those business units and getting approval for your network infrastructure design can take a lot of time and work.

On the other hand, if the company carries the network infrastructure as an overhead cost item, and the IT budget is centrally administered, there will probably be fewer people who need to approve it. Your life will then be somewhat easier. In any event, get all the "signers" involved in the planning process as early as possible.

## Outsourcing

Many organizations are focused on products or services that are not technical in nature. These organizations may not have technically competent employees, and they do not want to go to the expense of hiring, training, and supporting such employees. Often these organizations will contract with another company that specializes in providing professional IT services. This is commonly called **outsourcing**.

Sometimes all IT services are outsourced, and total responsibility for the success or failure of the network infrastructure rests with the outsource provider who designs, installs, administers, and maintains the network. Sometimes the responsibility is shared between the companies, with the outsourcing company providing only a portion of the network.

In your design process, you need to discover if any IT functions are currently outsourced. You will need to work with any outsource employees to gather appropriate information, and you may need them actively involved in the plan and implementation. They know the details of the network design intimately and can help you document the existing infrastructure design. They are *valuable* resources. They can also help you understand any current issues within the company so your infrastructure design can include them.

Ask questions to determine whether the company is satisfied with the contracting organization. These questions can include the following:

- Do they want to just continue to outsource what they presently are doing or would they like to bring some of the capability inside?
- Can the design and possible restructuring of the network be accomplished with internal talent?

Gather data on the capabilities of the people the plan must include. Once you get a picture of who needs to be included in the planning and/or implementation, you need to evaluate the need for training so that lack of expertise will not affect the rollout of your design.

## The Decision-Making Process

As a network designer, you need to understand how IT management decisions are made. IT management will probably follow the same process as the rest of the organization, but it is worth your time to investigate whether this generalization is true. Your project depends on it.

Often, large organizations have very complex approval chains for even the smallest expenditure, which means that it can take days, weeks, or even months to get a decision. In all cases, you need to determine who must "sign off" on the project. If these people are not included in the planning of the project, they could block its approval later. Be sure to find out who they are early, and include them as soon as possible in the process.

The IT decision-making process may follow the funding model, in that non-IT departments that fund IT will be represented on the planning team and will, at the very least, have an influence on the final decision. Sometimes, these non-IT departments will actually *make* the final decision. At the other end of the spectrum, you may find that the IT decision-making process gives the IT manager the authority to make a decision on the spot. If this is the case, your life is easier.

## Change-Management Process

When preparing for a major change, such as a network redesign, it is easy to only look ahead optimistically to the gains to be had by this change. You should also be evaluating other, potentially negative aspects of the change. For instance, whenever anything is changed in a production network environment, there is a risk that the change will cause something else to go wrong. Some other system could become nonfunctional due to human error, or implementing an incorrect change, or even implementing a correct change that turned out to be incompatible with another existing system. Often the people responsible for a system, although highly knowledgeable about their own system, may not be as knowledgeable about other systems that interact with theirs. This can cause a system failure, which can be time consuming and expensive to fix.

Many companies have instituted a change-management process to ensure that such a situation does not happen. The change-management process in a smaller organization might be as simple as having a knowledgeable manager approve the change. In other, larger organizations the change-management process might be highly structured and rigidly controlled. Detailed documentation might be required and proposed changes presented to a large group with representatives from each area of the company. Each department can express doubts about the proposed change and how it impacts their area of the company.

The purpose of a change-management process is to prevent expensive damage and problems caused by inappropriate changes to a production network environment.

Whether the organization has a change management process in place or not, act as if it does. Not every organization considers change-management as a discrete function. If you have not looked at the risks involved in the proposed changes yourself, you are not prepared to manage change. Predicting the risks of the new design will help the organization to prepare for worst-case scenarios.

## Questions to Ask About an IT Management Structure

The existing IT management structure will have a profound effect on how you go about creating your network infrastructure design. Because you (probably) must function within an existing organization, its policies, rules, history, attitudes, and previous successes and failures will guide you. You will want to develop a list of appropriate questions to ferret out the management structure of the IT organization.

Here are some questions to ask when gathering information on IT management:

- How is the network administered?
- Is it centrally managed and administered?
- Is network management distributed?
- Is network management a hybrid? In other words, is it centrally managed for major projects and strategic planning, but is day-to-day management distributed?

- Who are the team members and what are their roles?
- What policies will affect the plan and implementation?
- Who will be paying for this project?
- What is the funding method for IT?
- Are departments charged back for services provided by IT?
- Are IT functions internal to the company?
- What, if any, IT functions are outsourced?
- How are IT decisions made?
- What is the current change-management process?
- How can change management be integrated into this project?

After reading this section and studying the breadth and depth of the questions you need answered, our hope is that you now understand the extreme importance of learning about the IT organization you will be working in. The way you function within the IT organization you belong to can make or break your career as a network infrastructure designer.

## Chapter Summary

In this chapter we tried to give you some insights into how you analyze the business requirements of your company. We also wanted to give you some questions (which are really tools for discovery) to ask the organization for which you are creating the network infrastructure design. These insights and tools are designed to help you discover the real needs of the organization so that the infrastructure design you create truly meets those needs, both for the present and for several years into the future.

Consider the following facts from the chapter:

- We first explained why it is so important to understand the business requirements before starting the actual network infrastructure design. We also explained why this is difficult for many people, and described some consequences if it is not done.
- Then we gave you four measurement criteria by which you can gauge the success of your network infrastructure designs. Those criteria are functionality, availability, security, and performance. In the following chapters you will learn to use them to measure each aspect of your designs to ensure that they truly meet your company's needs.
- The discussion then introduced you to the life cycle of the network design and explained that it is not simply a go-through-it-once process. It is truly a cycle, and all of it, or some portions, will probably need to be repeated a number of times. The first two elements of the cycle, data gathering and data analysis, are fundamental to making correct design decisions.

- Then we gave you some insight into how companies can be looked at in various ways. The way they are organized, the way decisions are reached, the way employees are valued (or not, as the case may be), the geographic distribution of the company, and the national or international nature of the company are all factors that must be considered before beginning a network design. Even more important is learning how information and communication flows within the company, because that is what the network infrastructure design is supposed to enable and enhance.
- The discussion went on to cover company processes and organizational structures. Which model, or combination of models, management has chosen to operate under will tell you a lot about how you will need to work to be successful in the company. How the company is organized is critical because the network you design must mirror the organization. You may be required to expand the network infrastructure beyond the immediate company to accommodate customers, vendors, partners, and possible acquisitions, so your design must be robust enough to handle this broader area.
- We then discussed other elements that can impact your design. The priorities of the company, the projected growth and the strategy to achieve that growth, the laws and regulations that impact the design, the company's tolerance for risk, and an understanding of the total cost of ownership of the network are all important for you to understand.
- Last, we gave you some insight into how the IT organization itself is structured. You will be working closely with them, or actually be a part of them. So it is important for you to know how they are administered and how they are funded, whether they use outsourcing for some or all of their network resources, what their actual decision-making process is, and how they go about managing change.

In the next chapter we will explore how you analyze the technical requirements of the company.

## Key Terms

**availability** — The presence of a network service to provide supported services when needed. To provide a high level of availability (as in 24 hours a day, 7 days a week), there must be some redundancy built in.

**application portfolio** — The list of applications that your client requires be included.

**delegation of authority** — What occurs when upper management delegates specific fiscal or management authority to lower-level personnel, empowering them to act without consulting upper management.

**functionality** — The basic requirement of a service, such as file and print sharing, remote access, and WAN connectivity. Meeting the functionality criteria does not indicate that a service is properly configured for availability, security, or performance.

**Iron Triangle** — A metaphor to remind one that the three sides of the triangle, (load, resources, and performance) are tied together and relate to each other. If load is high and resources are low performance will suffer. If load is high and performance must be high, then either the load must be reduced or resources must be increased.

**outsourcing** — The term given to the process of contracting with an outside organization to provide some or all of IT or network infrastructure support and/or personnel.

**performance** — A measurement of the operation, function, and effectiveness of a service often related to how fast things happen.

**remote access** — A network model that allows users located physically at a distance from the network to access the network, using either a dial-in connection or a virtual private network (VPN) connection.

**scalability** — The ability of a computer or network to respond to increased demands.

**security** — Something that gives or assures safety. In networking this can include the authentication process and various methods of security access to individual network resources. The term also applies to the strength of security applied and the methods used.

**server roles** — The functions assigned to servers, such as file and print, applications, WINS, and DNS.

**services** — Software components that provide certain functionalities. Accessing this functionality often depends on a client component. For instance, the DHCP service provides automatic IP configuration to a computer configured to be a DHCP client. Microsoft Internet Information Services allows administrators to publish web pages that are accessible when users connect to the IIS server with an Internet browser, such as Internet Explorer.

**total cost of ownership (TCO)** — A term to remind people that the implementation cost of a system is only one part of the total cost. To appreciate what a system really costs, you have to include the design and implementation cost, the ongoing updates of the system, the training of administrators and users, regular maintenance of the system across time, and technical support required to keep the system going.

## Review Questions

Questions 1–6 are based on the following case:

Catalogall is a small specialty catalog sales company owned and managed by the Smith brothers. The company presently has five specialty catalogs for the pet owner market. The brothers, John and David, are president and vice president, respectively; David is in charge of all operations of the company, and John is head of finance.

They have three physical locations: the corporate headquarters (200 employees) and warehouse distribution centers in Memphis and Denver (about 20 employees each). The company has 30 employees at headquarters dedicated to order taking.

Over the last two years, Catalogall has established e-commerce sites for the five catalogs. As a result, sales have increased by 85%, without the need for additional order-taking staff, because most of this increase came from automated Internet sales. They are adding two more warehouse distribution centers in Edison, NJ, and Torrance, CA. They are also establishing better processes with some of their suppliers, so that many orders can be shipped directly from the supplier.

Although they offer new product catalogs throughout the year, 65% of their sales are gift purchases during the end-of-year holiday period.

The company has a single NT domain and plans to migrate to a Windows 2000 Active Directory domain by the end of the next quarter. By the following quarter, they plan to connect each of the company-owned sites together and establish network connections to suppliers.

1. You are the Information Systems manager for Catalogall. The president and founder, John Smith, is questioning your plan to do a complete analysis before proceeding with the migration and network changes. He has asked you to justify the time and expense of the business requirements analysis, suggesting that you simply proceed with the changes. Write a paragraph to explain the need for analysis and planning.
2. David Smith has asked you to explain what criteria will be used to measure the success of your resulting plan. List the criteria and give a brief description of each.
3. Of the geographic company models described in this chapter, which fits the Catalogall company?
4. Can you identify any product life cycles at Catalogall?
5. Describe the probable decision-making process at Catalogall.
6. Which management model fits Catalogall?
7. Place the following steps of the design process in linear order, starting from the first that would occur and going to the last that would occur:
   a. network implementation
   b. network testing
   c. data gathering
   d. network management
   e. data analysis
   f. design decisions
8. Although we have given an order to the design process steps, the process still can be described as which of the following? (Choose all that apply.)
   a. ongoing
   b. cyclic
   c. frozen
   d. linear
   e. static

9. Network services _____. (Choose all that apply.)
   a. give users word-processing capabilities
   b. include great game software
   c. provide access to network resources over the physical infrastructure
   d. provide support for network-based applications
   e. provide support for authentication methods
10. How many years should a network infrastructure design last?
   a. two
   b. three
   c. ten
   d. five
   e. It varies.
11. Network infrastructure design only involves the physical elements. Is this statement true or false? Explain your answer.
12. Functionality means that the service design provides _____.
   a. 24/7 availability
   b. the basic purpose required
   c. the fastest access possible
   d. secure connections
13. Blue Owl is a large consumer food company. Their product line includes frozen vegetables, pizzas, frozen dough products, and desserts. You are on the network design team developing a plan to expand the corporate intranet over the next three quarters. You have determined that many of the company products have a life cycle. Explain the nature of the product life cycle and how it may affect your design in general.
14. Although Blue Owl is a large company with $2 billion in annual sales and 8,000 employees, middle managers are given a great deal of discretion in decision making within their departments. The new network changes will be charged back to the departments per a complex allocation formula. Therefore, each manager must sign off on these costs before the CIO finally approves the project. How will this affect your project?
15. In this chapter, in the Organizational Structures section, a computer company is described. (*Hint:* It supplied computer parts to a number of independent computer system builders.) Summarize the management model of that company.
16. Give an example of a customer relationship that would have to be considered in a network plan.
17. Give an example of a vendor or partner relationship that would have to be considered in a network plan.

18. The IS manager at Johnson Hospital in Chula Vista, CA, has asked you to define for his staff exactly what they should include in their computations for TCO. List the costs, by category, that need to be included.
19. As part of the planning team for a network redesign at Blue Owl, you have been asked to gather information on organization priorities. Explain why organization priorities are important to the design plan.
20. You have been asked to do a risk analysis for the Blue Owl project. Hearing about this assignment, one of your team members is worried that there is a problem with the project. What would you say to resolve his fears?

## HANDS-ON PROJECTS


### Project 2-1 Analyzing Business Data

In this project you will read a description of an organization and create a diagram of the geographic organization.

Willow Harbor Financial is a large international company with headquarters in London and locations in five countries. The London campus includes both the corporate headquarters and the regional offices with separate staff functions for each. The branch offices offer customer financial services. Table 2-1 lists Willow Harbor's locations.

**Table 2-1** Willow Harbor Financial Offices

| Country | Regional Office | Branch Office |
|---|---|---|
| United Kingdom | London (Note that the headquarters and the regional office share the campus, but not staff or other functions; in effect, they are separate organizations.) | Birmingham<br>Dublin |
| France | Paris | Lyons<br>Marseilles |
| Germany | Frankfurt | Munich |
| Spain | Madrid | Cartagena |
| United States | Chicago | Los Angeles<br>Atlanta |

Use diagramming software, such as Microsoft Paint, AutoCAD, or Visio, to create a diagram of the geographic organization of Willow Harbor Financial. You also can use the draw features of Microsoft Word.

1. Start a diagramming or word-processing program that has a draw feature.
2. Open to an empty drawing area.
3. Create a title at the top of the page: **Geographic Organization of Willow Harbor Financial**.

4. Create a box at the top center of the drawing area.
5. Label the box, **London, UK — Corp. HQ**.
6. Create five boxes below London to represent the regional offices.
7. Label each of the regional offices according to the table.
8. Below the five boxes for regional offices, create eight boxes to represent the branch offices.
9. Label the branch offices per Table 2-1.
10. Use the line-drawing tool to add lines connecting the London box with the box for each of the five regional offices.
11. Use the line-drawing tool to add lines connecting each regional office with its branch offices.
12. Save the drawing, print it, and keep a hard copy in your lab journal.


## Project 2-2 An Argument in Favor of Network Planning

To further support the argument in favor of careful network planning, you will use the Internet to find a case study of network design and report on it.

1. Open Internet Explorer or another browser.
2. Go to *http://www.3com.com/technology/tech_net/white_papers/index.html*. Turn on your mental "marketing filters," because this site is designed to promote 3Com products. However, you will find a wealth of good technical information here.
3. Scroll down the page and search through the case studies for one titled, "Understanding the Impact of Core Intranet Applications on Your Network."
4. Read this case study, and use a word processor to write a summary that supports the argument in favor of careful network planning.


## Project 2-3 Diagramming Information Flow

In this project you will create a diagram of the information flow of an organization. Using the specialty catalog company described in the Information Flow section of this chapter, you will follow the information flow of the outdated system first described.

1. Start a diagramming or word-processing program that has a draw feature.
2. Open to an empty drawing area.
3. Create this title at the top of the page: **Information Flow: Order Processing**.
4. Create an object representing the customer.
5. Create another object representing the order taker.
6. Connect these two objects with a double-headed arrow to indicate that the information flow is two-way.
7. Label the line **Initial Order**.

8. In the next step of the process, the clerk checks the inventory database to confirm availability before placing the order. Create a symbol to represent the inventory database below the order-entry clerk.
9. Draw a single-headed arrow from this database object to the order-entry clerk and label it **Inventory Data**. Since this is a query of the database, the arrow pointing back to the clerk shows the flow of information to the clerk.
10. Next in the process, the order taker must enter the customer information and order detail into the computerized order-entry system. Create a symbol to represent this system and put it on the lower-left side of the picture.
11. Connect the symbol for the order-entry person to the new symbol with a single-headed arrow pointing to the order-entry system. Label it **Customer Information and Order Detail**.
12. Connect the database symbol to the order-entry system with a double-headed arrow. Label it **Database Access and Updates** to indicate that the order-entry system adjusts the inventory quantity automatically.
13. Next in the process, the order gets sent to the warehouse to have the products picked from the shelves and transported to shipping. In this case the order-entry system automatically prints at the warehouse. Create an object to represent the warehouse and draw a single-headed arrow connecting the order-entry system object and the warehouse object. This arrow points to the warehouse. Label it **Stock Picking Order**.
14. Save the drawing, print it, and keep a hard copy in your lab journal.


## Project 2-4 Analysis of Company Models

In this project you will use your Internet browser to look at various web sites to determine company models. Use your word processor to record your responses to the questions posed in the project:

### Pillsbury Company

1. Open Internet Explorer or another web browser.
2. Go to the Pillsbury web site at *http://www.pillsbury.com*. If an e-mail sign-up window opens, close it.
3. Click **Around the World**.
4. Read the information on this page and determine which geographic model applies to Pillsbury. Write a sentence explaining why you believe this model fits.

### Community National Bank

1. Use your Web browser to go to the following site: *http://www.communitynational.com*.
2. Click the **Click Here** button.
3. Click **Locations**.

4. Read the information on this page and determine which geographic model applies to Community National Bank. Write a sentence explaining why you believe this model fits.

### Rutgers University

1. Use your Web browser to go to the following site: *http://www.rutgers.edu/*.
2. Read the information on this page and determine which geographic model fits Rutgers University. Write a sentence explaining why you believe this model fits.

### Verizon

1. Use your Web browser to go to the following site: *http://www.verizon.com/*.
2. Read the information on the home page.
3. Point to and click **About Verizon**.
4. Read this page and learn about the merger of Bell Atlantic and GTE.
5. On the left side of the page, click **International**. This tells you that Verizon is an international company, but there is more to the story.
6. Use your Web browser to go to the following site: *http://www.verizoncsi.com/*.
7. Read the home page for Verizon Connected Solutions.
8. Click **About Us**.
9. Click **Profile of Connected Solutions**.
10. Read the company profile page.
11. Write a sentence defining the geographic model of Verizon including this subsidiary.


Organizations only publish information on Web sites that they feel promotes the image of the company and serves their customers, so you will have to do some surmising to come up with answers. As a designer you would have access to internal information that would not be revealed on a web site, but it is interesting to see how much you can discover about an organization by browsing its web site.


## Project 2-5 Analyzing Gathered Data

Read the following profile and then open a word-processing program and write a few paragraphs describing what you identify as company strategies, being sure to provide overall objectives, company priorities, and the difference between past and desired growth strategies.

### Profile

Strawberry Communications is preparing to design a network infrastructure for their planned migration to Windows 2000. They hope to improve their network and processes to gain a competitive advantage.

Strawberry Communications is a wireless pager communications provider based in Boston, with operations in 40 states. It currently has 3,000 employees and has gone through aggressive growth both internally and from the acquisition of regional communications companies. Previously, most information systems decisions were made at the division level without a corporate-wide plan. Each division had its own accounting system and PC use was confined to individual desktop applications. In late 2000, Strawberry Communications developed a centralized Information Systems Strategic Plan. This network redesign was specified in that plan, with the following corporate objectives:

- Increase shareholder value
- Increase the subscriber base to 12 million pagers by the year 2005
- Be a low-cost service provider
- Establish a national presence and network capability

The following problems were limiting efficiency and growth:

- Many of the company's processes are inefficient and slow, with many manual activities.
- Geographic and sales growth through acquisitions result in inconsistent procedures and information systems across the company.
- Decision makers find that management information is difficult or impossible to retrieve.
- Ready access to information, which is essential to providing better customer service, is not available.

Consequently, they determined that the following guidelines would have to be followed to ensure that the design met the objectives:

- The network design should demonstrate clear business value.
- It should follow standards where possible.
- It should use mainstream vendors.
- It should provide flexibility.
- Information should be entered into systems once and then distributed to the applications needing to share this information.
- It should make data accessible to anyone with proper security privileges, anywhere, anytime.


## Project 2-6 Stanford School of Medicine Information Technologies

In this hands-on project, you will use your Internet browser to explore the web site of the Stanford School of Medicine Information Technologies. You will need Acrobat Reader installed to complete this project. After exploring the pages, use a word processor to answer the following questions:

1. What did you surmise about the IT management structure?
2. What did you surmise about the academic management structure?
3. How would you compare the IT management structure with the academic management structure?
4. Is there any indication of how IT is funded?
5. What is the main goal of the Network Infrastructure Upgrade project?

1. Use your Internet browser to go to *http://med.stanford.edu/* and read the home page.
2. At the bottom of the page, click **MedIT**.
3. On the left side of the page, click **Network Planning** and read the Network Planning page.
4. On the Network Planning page, click each of the links at the bottom of the page and read each page, returning to the Network Planning page when done.
5. On the left side of the Network Planning page, click the **Systems Security** link and read the Systems Security page.
6. Under Security Resources on the Web, click **Stanford's Computer and Network Usage Policy**.
7. On the Stanford University Administrative Guide page, click **Chapter 1: University Organization**.
8. Click **Organization Chart: President** and read the chart.
9. Click the **Back** button in your browser to return to the Stanford University Administrative Guide Chapter 1 page.
10. Click **Organization Chart: Provost** and read the chart.
11. Click the **Back** button in your browser to return to the Stanford University Administrative Guide Chapter 1 page.
12. Click the **Back** button in your browser until you return to the Stanford University Security Tips page.
13. On the Stanford University Security Tips page, locate **Network Ops** and click it.
14. On the Network Operations page, click the link to Frequently Asked Questions (FAQs). Explore the information.
15. Answer the questions posed at the beginning of this project and save your work in a word-processing file.

## CASE PROJECTS


### Case 2-1 Sunrise Connected Services Project: Analyzing Business Requirements

Sunrise Connected Services (SCS) is a five-year-old subsidiary company of Sunrise, a large telecommunications company. SCS's initial business was providing premises-based, structured wiring services for residences and business communications wiring for both homes and commercial sites. This narrow focus has been expanded to include new high-tech communications products and services. These range from networked home entertainment and control systems and Internet connections to home and office LAN and WAN networks.

SCS is currently located in the northeastern United States from Virginia to Maine, and also includes Pennsylvania and West Virginia. In addition to the corporate headquarters and data center in Maryland, they have seven regional administrative locations and more than 60 smaller branch locations. SCS has 3,500 employees: 400 work at headquarters and the data center; 100 are distributed at the various branch locations using desktop computers; and another 300 users with laptops access the network remotely.

SCS has a fairly small management team with several combined positions. The top management includes the president, vice president/chief information officer (CIO), chief financial officer/treasurer, vice president/operations, and vice president/human resources and labor relations. The VP/CIO has an information services manager who manages daily operations of IS, but the CIO must sign off on any project of this size. This project will also need the approval of the VP/operations.

The project involves planning for the upgrade to a Windows 2000 Active Directory domain. You are on the team that must evaluate the network before the servers are upgraded to Active Directory. The Active Directory planning has been completed. Your group will need to determine what changes may need to be made to the network to accommodate the services to support Active Directory.

1. Based on the information provided, how would you describe the geographic business model of SCS?
2. The information given is a good starting place, but there are many gaps in the information. Describe the areas you will want to investigate further.
3. What questions do you have concerning the future of the company?


### Case 2-2 Exploring Your Community

Search for four organizations in your community that have product or service cycles and describe the cycles. In what way are they similar? In what way are they different? (*Hint:* Try imagining your day-to-day activities as you explore this case. For instance, where do you shop for groceries? Where do you buy gasoline? These types of questions will reveal a multitude of candidates for this case.) Write your findings and save your work in a word-processing file.


## Case 2-3 Hidden Facts in a Business Analysis [Optional Case Project for Teams]

Imagine that you and your team members are designing a network for an online university of 1,000 students. What type of business model do you expect this online university to have? Do you think the business model of the academic side of the university matches the business model of the administrative side of the university? Why or why not? List three goals that you think an online university might have. List one way a poor network design could thwart each of those goals. Write your report, save it in a word-processing document, and present the information to your class.